Ambient light exposure influences childhood eye growth

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PURPOSE

- Although there is evidence that outdoor activity is an important factor involved in the development of childhood refractive error,[1,2] the mechanism underlying the association between more outdoor activity and less myopia in childhood is not clear.
- In this prospective longitudinal study, the relationship between objectively measured ambient light exposure and eye growth in childhood was examined.

METHODS

- One hundred and one children aged 10-15 years participated in the study:
  - **41 myopes** (mean SER: -2.39 ± 1.51 D).
  - **60 non-myopes** (mean SER: +0.35 ±0.31 D).
- Axial length was measured every 6 months over an 18-month period using the Lenstar LS900 (i.e. 4 visits over 18 months).
- Objective measures of personal ambient light exposure were also collected using wrist-worn light sensors (Actiwatch-2) (Fig. 1).
- Nearwork and outdoor activities were assessed using questionnaires.[2]
- Linear mixed models were used to examine the significant predictors of axial eye growth over the 18 months of the study.

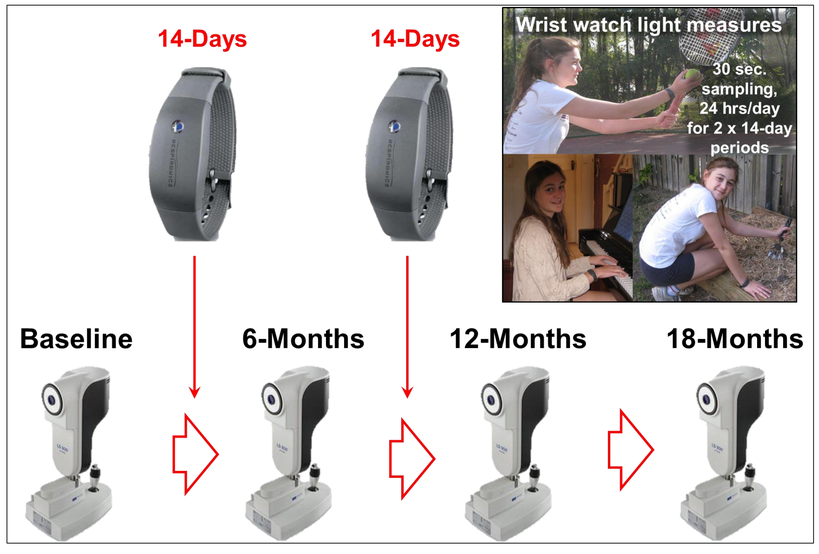

Fig. 1. Overview of the study protocol involving measures of axial length every 6 months over an 18-month period, and two 14-day periods of personal ambient light exposure measures.

RESULTS

- Significantly greater mean daily light exposure was observed in the non-myopic children (mean exposure between 6am and 6pm: 999 ± 468 lux) compared to the myopic children (mean 805 ± 427 lux) ($p<0.05$) (Fig. 2).

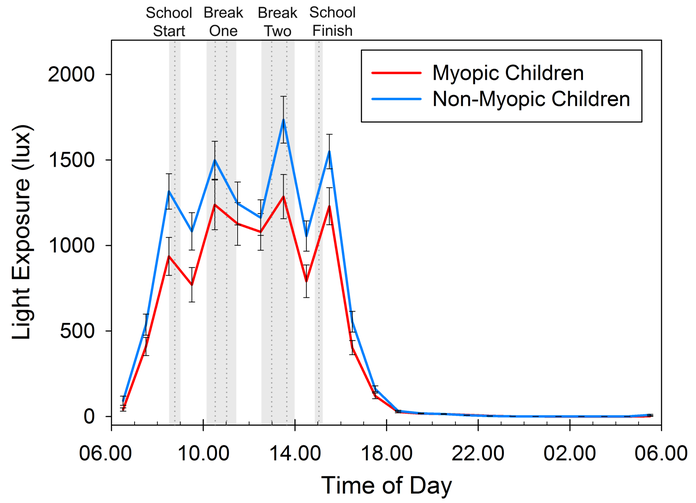

Fig. 2. Mean daily light exposure in the myopic (red line) and non-myopic (blue line) children. Error bars indicate the standard error of the mean. Vertical lines indicate timing of school breaks.

- Axial length increased significantly over time in both the myopic and non-myopic children ($p<0.001$) (Fig. 3).
- The significant predictors of axial eye growth included: refractive group ($p<0.001$), age ($p<0.01$), gender ($p<0.05$) and (log) average daily light exposure ($\beta = -0.12$, $p<0.05$).

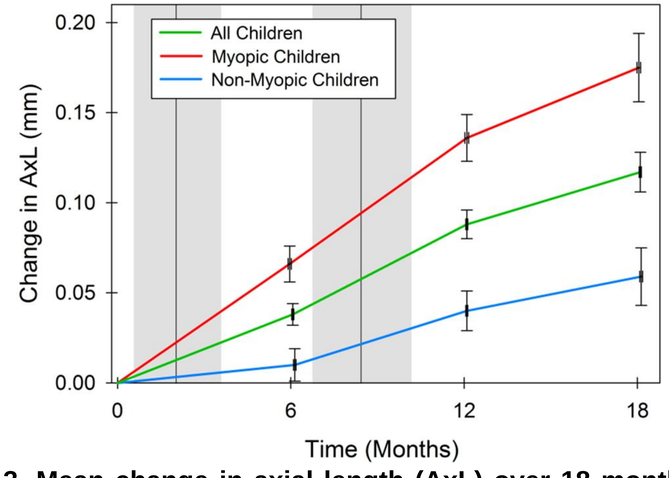

Fig. 3. Mean change in axial length (AxL) over 18 months in the myopic (red line), non-myopic (blue line) and all children (green line). Error bars indicate the standard error of the mean. Vertical black line indicates mean timing of light exposure measures.

- Children were stratified based upon a tertile split of their mean daily light exposure as habitually experiencing:
  - ***Low daily light exposure (≤ 651 lux):*** Mean 459 ± 117 lux, 56 ±18 mins/day exposed to >1000 lux.
  - ***Moderate daily light exposure (652-1019 lux):*** Mean 842 ±109 lux, 91 ±13 mins/day exposed to >1000 lux.
  - ***High daily light exposure (≥ 1020 lux):*** Mean 1455 ± 317 lux, 137 ± 29 mins/day exposed to >1000 lux.
- Children habitually experiencing low daily light exposure exhibited significantly faster axial eye growth compared to moderate and high light exposure, adjusting for age, gender, nearwork and refractive group ($p=0.02$) (Fig. 4).

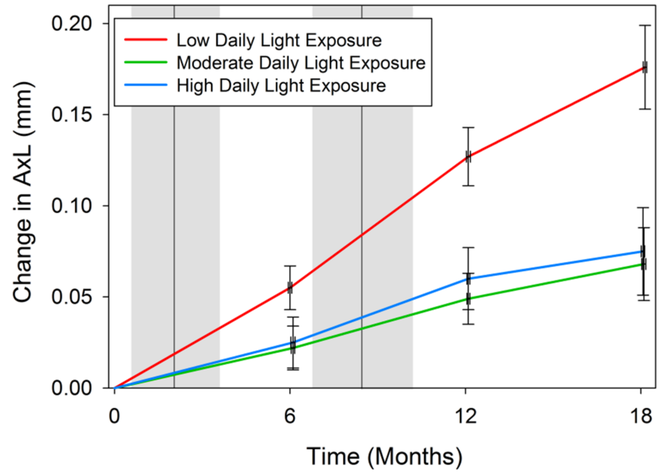

Fig. 4. Estimated mean change in axial length (AxL) in children habitually experiencing low (red line), moderate (green line) and high (blue line) daily light exposure. Error bars indicate the standard error of the mean. Vertical black line indicates mean timing of light exposure measures.

CONCLUSIONS

- This study provides the first evidence of an association between greater (objectively measured) light exposure and slower axial eye growth in childhood.
- These findings support a protective role of bright light in the documented association between time outdoors and myopia, and provide empirical evidence for interventions aimed at increasing light exposure to reduce the incidence and progression of myopia in childhood.

REFERENCES

1. Mutti et al. *Invest Ophthalmol Vis Sci.* 2002; 43: 3633-3640
2. Rose et al. *Ophthalmology.* 2008; 115: 1279-1285

Disclosures: None